SYNTHETIC BIOLOGY: Scientists Create First Living Organism From Artificial DNA

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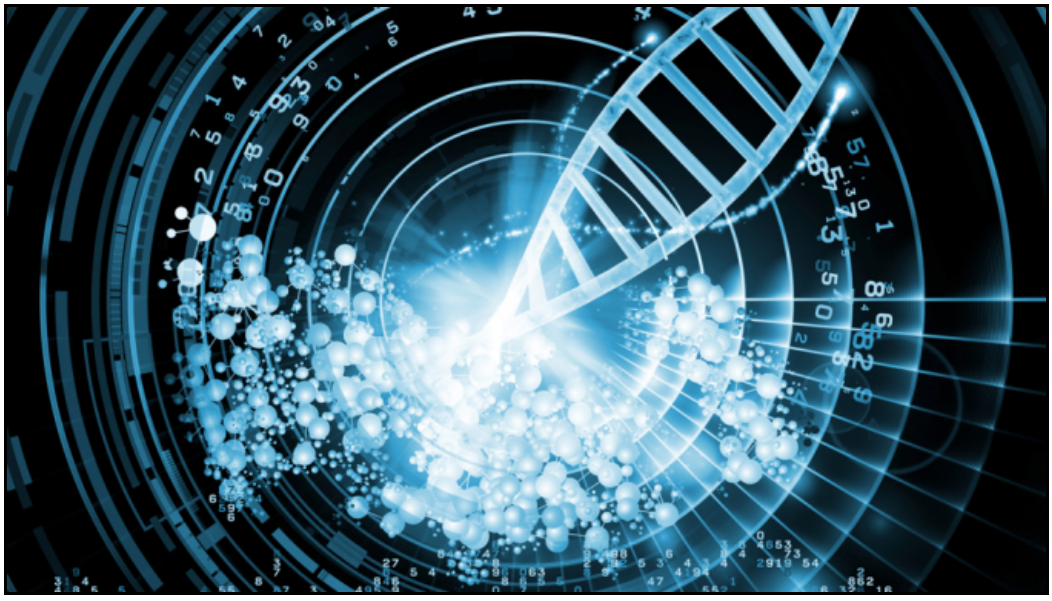


A team of researchers from **The Scripps Research Institute** (TSRI) in La Jolla, California has created a **brand-new bacteria** based on a genetic structure that is nowhere to be found nowhere this planet.

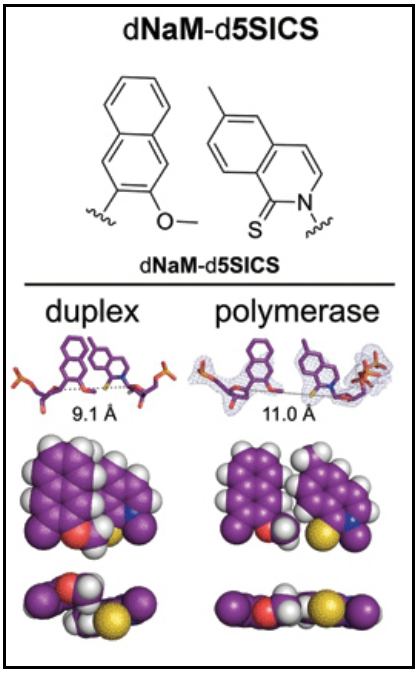
According to lead researcher **FLOYD ROMESBERG**, the feat involved artificially engineering a unique combination of **DNA** material — a combination not found in any living creature — and then inserting it into a living cell that usually contains only *natural* combinations of DNA.

> ***"Life on Earth in all its diversity is encoded by only two pairs of DNA bases, A-T and C-G,"*** Romesberg explained in an institute news release. ***"And what we've made is an organism that stably contains those two, plus a third, unnatural pair of bases. This shows that other solutions to storing [genetic] information are possible,"*** he added, ***"and, of course, takes us closer to an expanded-DNA biology that will have many exciting applications —***

from new medicines to new kinds of nanotechnology."

The product of more than **15 years** of work, the current effort builds upon a proof-of-concept study that was conducted in 2008. At that time, investigators showed that hooking up natural and unnatural pairings of DNA was possible in a test-tube setting.

The next challenge was to replicate the process inside a living cell. The cell chosen by the TSRI team was the common **E. coli bacterium**, and into it they inserted what they considered to be the best unnatural DNA pairing that they could construct: a combination of two molecules called "**dNaM**" and "**d5SICS**".



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After creating and testing **300** variants, the authors of the study finally achieved their goal: **a half-synthetic organism that, when continuously supplied with the necessary molecular material, could replicate its unnatural self.**

In effect, the bacteria have a genetic code of **six** letters rather than **four**, perhaps allowing them to make novel proteins that could function in a completely different way from those created naturally. This accomplishment may eventually lead to organisms that can make new medicines or industrial products which cells that contain only the natural genetic code cannot.

The scientists behind the work at TSRI have already formed a company to try to use the technique to develop new antibiotics, vaccines and other products, though a lot more work needs to be done before this is concept is made practical.

The work also gives some support to the concept that life can exist elsewhere in the universe using genetics different from those on Earth.

"This is the first time that you have had a living cell manage an alien genetic alphabet," said **STEVEN A. BENNER**, a researcher at the **Foundation for Applied Molecular Evolution** in Gainesville, Florida.

This research is bound to raise safety concerns and questions about whether humans are *"playing God."* The new findings could intensify calls for greater regulation of the budding field known as **Synthetic Biology**, which refers to ***"both the design and fabrication of biological components and systems that don't already exist in the natural world, and the re-design and fabrication of existing biological systems."***

> ***"The arrival of this unprecedented 'alien' life form could in time have far-reaching ethical, legal and regulatory implications,"*** said JIM THOMAS of the **ETC Group**, a Canadian advocacy organization. ***"While synthetic biologists invent new ways to monkey with the fundamentals of life, governments haven't even been able to cobble together the basics of oversight, assessment or regulation for this surging field."***

Dr. Romesberg dismissed concern that the organisms would run amok and cause harm, saying that the technique was safe since the synthetic nucleotides were fed to the bacteria. Should the bacteria escape into the environment or enter someone's body, they would not be able to obtain the needed synthetic material and would either die or revert to using only natural DNA.

"This could never infect something," he said. That is one reason that the company he co-founded, **SYNTHORX**, is looking at using the technique to grow viruses or bacteria to be used as live vaccines. Once in the bloodstream, they would conceivably induce an immune response, but not be able to reproduce.

AMBRX, a San Diego company that has filed to go public, is incorporating the novel amino acids into certain proteins that are used as drugs in an effort to make the drugs more potent in killing tumors or make treatments last longer in the bloodstream.

"It took some clever problem-solving to get where they got," said **ERIC T. KOOL**, a professor of chemistry at Stanford who is also doing research in the area. ***"It is clear that the day is coming that we'll have stably replicating unnatural genetic structures."*** (**Self-replicating nanobots? ...**)

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